

APPENDIX 13
SCUBA EXAM (June 1999 Edition)

NAME: _____ **Date:** _____

Score: _____

Instructions and Notes: This is an open book exam. Answers to all questions can be found in the following texts: Department Diving Safety Manual, NOAA Dive Manual, US Navy Diving Manual (Volume 1), USCG Rules of the Road, and various recreational dive texts (i.e. NAUI Advanced Diving, PADI Encyclopedia of Recreational Diving, etc.).

Where conflicts arise the Department and NOAA manuals will prevail. Dive table answers will be derived using the enclosed tables (USN). You must show your work on the exam, or on a plain piece of white paper with the question number on all responses requiring calculations or use of the dive tables.

Please provide the text reference for your answer (where appropriate) next to the question number.

EQUIPMENT:

1) What is the most important feature required on all belts and harnesses used in diving?

- a) Corrosion resistant material
- b) Right hand quick release connection
- c) Elastic material for comfort
- d) Natural color to blend in to background
- e) Environmentally friendly material

2) What procedure would you use to check your buoyancy compensator before diving?

- a) Inflate the device orally
- b) Inflate the device using the power inflator
- c) Deflate the device using the deflator
- d) Squeeze the device to test the overpressure valves
- e) All of the above

- 3) Which of the following are not the correct names of a SCUBA tank valve?
- a) J-valve
 - b) K-valve
 - c) DIN valve
 - d) Schraeder valve
 - e) All of the above
- 4) Refer to Figure 1 (Attached), and label the following:
- a) Purge button
 - b) Diaphragm
 - c) Exhaust valve
 - d) Second stage downstream valve
 - e) Mouthpiece
- 5) An 1800 psi cylinder is pressurized to ____psig when hydrostatically tested?
- a) 1800 psig
 - b) 2250 psig
 - c) 3000 psig
 - d) 4500 psig
 - e) None of the above
- 6) The reserve lever on a J-valve needs to be in what position when being filled?
- a) Down
 - b) Up
 - c) In the middle
 - d) It doesn't matter
- 7) Green discoloration on the first stage filter suggests what CONDITION?
- a) The pressure rating of the filter assembly
 - b) Exposure to excess pressure
 - c) The color of the material
 - d) Exposure to salt water and corrosion
 - e) None of the above

8) Which of the following describes the difference between steel and aluminum SCUBA cylinders?

- a) Steel cylinders are heavier
- b) Steel cylinders are stronger
- c) Aluminum cylinders hold more air
- d) Aluminum cylinders last longer
- e) All of the above

9) Explain the meaning of each legally required mark that appears on the neck of a SCUBA tank including: alloy designation, hydrostatic test date, working pressure, and over-pressure designation.

10) Explain the proper use of dive computers among buddy teams.

11) State the type of depth gauge that automatically compensates for high-altitude diving.

12) Define the terms *balanced*, *unbalanced*, *upstream* and *downstream* as they relate to regulator design.

13) What is the safety device that prevents an over pressurized SCUBA tank from exploding?

- a) Burst disc
- b) Schraeder valve
- c) Cylinder liner
- d) J-valve
- e) Stem gauge

14) What type of regulator will maintain a constant intermediate pressure in spite of varying tank pressure?

- a) Upstream tilt valve second stage
- b) Downstream tilt valve second stage
- c) Balanced piston first stage
- d) Balanced diaphragm first stage
- e) C and d above

15) Bourdon tubes are most commonly found where?

- a) Underwater compass
- b) Depth gauges
- c) Regulator stages
- d) Submersible pressure gauge
- e) B and d above

POLICY:

16) What are the required inspection periods for the following:

- a. Regulator _____mo.
- b. VIP _____mo.
- c. Hydrostatic test _____yr.
- d. SPG _____mo.
- e. Buoyancy compensator _____mo.
- f. Depth gauge _____mo.

17) Under what conditions may a Department diver make a job related decompression dive?

18) What three (3) items of diving equipment or diving environments require additional training not covered in the Department certification course?

19) Name two (2) types of breathing apparatus, other than open circuit, available to Department divers and list the criteria that has to be met before their use.

ENVIRONMENT:

- 20) What is a current that runs from shore outward though the surf called?
- 21) List three (3) general safety considerations to be determined before diving in unfamiliar locations.
- 22) You will be entering and exiting through moderate surf. Describe factors to be considered, decision points and alternatives in planning a safe dive.
- 23) The horizontal boundary between waters of differing salinity is called?
- 24) The horizontal boundary between waters of differing temperature is called?
- 25) The distance between successive wave crests or troughs is called?
- 26) Currents in bodies of water are primarily caused by what?
- 27) What is the direction of rotation for the predominant ocean currents in the Northern Hemisphere?
- 28) What is the most useful diving skill for avoiding damage to the marine environment?
- 29) Define magnetic Variation and Deviation as it relates to marine navigation.
- 30) You see a vessel at night displaying three (3) lights in a vertical line, top and bottom being red and the middle being white. What does this mean? What would this vessel display during daylight?
- 31) You are asked to make a dive in an area with a lot of protected coves, there are rough conditions outside of the coves. Your plan is to enter the water in one of these coves, submerge, and proceed to the dive location by compass. While still in transit, you notice giant kelp angled steeply in your direction of travel. At 500 psig, you complete your dive. Your team surfaces to discover yourselves ¼ mi. South of the cove. How could you have kept your team out of this situation?

- 32) What is the geographic feature at 41°21'N, 124° 11'W?
- 33) Give the conditions you would expect if the weather report stated Beaufort Force 6.
- 34) What causes waves to break right on shore? Could this be a problem for a beach entry?
- 35) In general what state of tide offers the best visibility?
- 36) What type of weather would you expect from a warm front?

PHYSIOLOGY:

- 37) Fatty tissues under hyperbaric conditions accumulate which gas found in air?
- a) Nitrogen
 - b) Oxygen
 - c) Hydrogen
 - d) Xenon
 - e) Nitrous Oxide
- 38) You are planning a dive with a beach entry. There is a 6 ft. swell running. Of what pressure related problem must you be aware?
- a) Barotrauma
 - b) Mediastinal emphysema
 - c) Subcutaneous emphysema
 - d) Decompression sickness
 - e) Nitrogen narcosis
- 39) Why is hyperventilation dangerous when skin-diving?
- 40) Why is equalizing your ears more difficult while descending from the surface to 33 ft. than from 100

to 133 ft.?

Describe the following. Give cause, symptoms, and preventive action:

41) Hypothermia

42) Carbon Dioxide excess

43) Carbon Monoxide excess

44) Pneumothorax

45) Mediastinal and Subcutaneous Emphysema

46) Nitrogen Narcosis

47) Embolism

48) Decompression sickness

49) Explain the physiological mechanism that causes a *carotid sinus reflex*, and how this affects the diver. How can this be avoided?

50) Label the areas of the ear most affected by changing pressure (see Figure 2, attached).

51) Define the term *silent bubbles* as it relates to decompression sickness.

52) The best First Aid for an air embolism or DCS is?

53) Symptoms of DCS will occur in about 98% of the cases within how many hours of surfacing?

54) When problems are experienced with equalizing due to congestion in the sinuses, the best procedure is?

55) Symptoms of O₂ poisoning include:

56) Non-frothy blood in the mask after ascent is a sign of what?

- a) Impacted tooth
- b) Pneumothorax
- c) Decompression sickness
- d) Conjunctival hemorrhage
- e) Ruptured sinus

57) Conjunctival hemorrhage can be caused by what piece of dive gear?

- a) Non-adjustable fin straps
- b) Straps which become too tight at depth
- c) Snorkel mouthpiece
- d) Mask
- e) None of the above

58) The minimum depth at which a SCUBA diver can experience an air embolism is?

59) What is the only effective treatment for DCS?

60) Give three (3) rules to avoid air embolism.

61) What is hyperthermia? How can you prevent it?

62) Explain how proper diving technique and equipment can prevent exhaustion and excessive buildup of Carbon Monoxide.

PHYSICS:

Define the following terms:

63) Gauge pressure

64) Absolute pressure

65) What is the absolute pressure at the following depths?

27fsw	___psia
57fsw	___psia
101fsw	___psia
38ffw	___psia

66) The air you breath from a SCUBA tank is _____ as dense at 33fsw as it is at sea level.

67) Two (2) SCUBA tanks are available for a dive to 50fsw, you want the one that will provide the most air. One tank is an aluminum '80' filled to 2000psig, the other is a steel '72' filled to the same pressure. Which do you choose?

68) What temperature change occurs in a SCUBA tank being filled?

69) What is the Surface Equivalent (SE) of 1% CO at a depth of 66fsw?

70) If the breathing gas in you SCUBA tank is 20% O₂, what will be the partial pressure (ppO₂) at a depth of 66fsw? What will the SE be?

71) Assuming a 20% O₂ mix, at what depth will the risk of oxygen toxicity become a priority?

72) What is the partial pressure of the following gases at the stated depths?

a. Sea level: Nitrogen (N) _____ Oxygen (O_2) _____

b. 33fsw: Nitrogen (N) _____ Oxygen (O_2) _____

c. 41fsw: Nitrogen (N) _____ Oxygen (O_2) _____

73) What is the percentage of volume reduction experienced by a gas in a flexible container when taken from sea level to 33fsw?

74) Explain why water is able to dissipate heat faster than air and what effect this has on a diver.

75) A balloon filled with air has a volume of six (6) cubic feet at 99fsw, what will the volume of the balloon be at 66fsw? If taken to the surface what might happen?

76) The different in weight between two(2) cubic feet of fresh water and the same volume of sea water is?

77) A neutrally weighted ocean diver and his equipment weight 200lbs. How much will he adjust his weight to be neutral in fresh water?

78) How many 50 lbs lift bags, weighting 2 lbs each, are needed to lift a three(3) cubic foot object with a dry weight 287 lb from a depth of 102 ffw?

79) If you fill a SCUBA tank to 2100psig at sea level, then lower the tank to 99 fsw, what will the pressure in the tank be?

80) Why do increased depths make a diver less buoyant? What can you do about it?

81) If at your present surface air consumption (SAC) you use a tank in 60 minutes, how much time will you have at 66fsw?

82) Absolute pressure which is equal to twice atmospheric pressure is found at what depth?

83) At what depth does $ppO_2=1.0$ Atmospheres?

84) As the partial pressure of a gas increases what happens to that gases solubility?

85) What happens to light as it enters the water? What is this phenomenon called?

86) Why can't you determine direction of sound underwater?

87) Using the 'Rule of Thirds' as a guideline determine the outcome of the following:

Diver 1 is using a 100 cubic foot tank @ 3500psi and breaths 14 psi/min. at the surface.

Diver 2 is using a 108 cubic foot tank @ 2640 and consumes 22 psi/min. at the seal level.

Diver 2 runs out of air during a 100 fsw dive just as Diver 1 reaches his 'turn point'. What happens if they cannot make a direct ascent to the surface? How could they better plan this dive?

DIVE TABLES:

USE ONLY THE TABLES PROVIDED (Attachment 3)

88) Define the following as they apply to computing dive profiles:

- a. Bottom time
- b. Depth
- c. Residual nitrogen time (RNT)
- d. Surface interval
- e. No decompression limit (NDL)

89) Why do residual nitrogen times generally decrease with increasing depth on repetitive dive tables?

90) You plan on making a series of dives in the same work day, would you make a precautionary decompression stop at the end of any of these dive? Why?

91) Will free diving between dives affect your dive profile? Should it?

92) You dive the following profile:

Dive 1 48min @ 66fsw
Surface interval 1hr 50 min
Dive 2 10min@75fsw

What is your group at the end of the first dive?

What is your group at the beginning of the second dive?

What is your group at the end of the second dive?

What group will allow another dive for 10 min. @ 60fsw?

What is the surface interval (SI) thy you will have to endure to make the above mentioned dive?

Is there anything wrong with this profile? Is it safe? How could it be make safer?

93) Consider the following profile:

0920 Start descent
0922 Arrive @ 40fsw
0925 Arrive @ 100fsw
0930 Arrive @ 60fsw
0935 Begin ascent
0939 Start descent
0940 Arrive @ 60fsw

Assuming a normal rate of ascent, when did you break the surface?

What is your repetitive group for the previous question?

When do you begin your final ascent to avoid the NDL?

What action would be easiest to do to make the profile safer?

94) Dive profile:

Dive 1	37min. @ 58fsw
Surface Interval	15min.
Dive 2	20min. @ 58fsw

What is your group after the first dive?

What is your group before the second dive?

What is your group after the second?

If it was necessary to decompress, what is the stop time and depth?

How can you make this dive safer?

95) Arrange the following dives in the safest order:

56min. @60fsw
30min. @20fsw
5min. @40fsw

SI is always 20 min.

What is your group at the beginning of the second dive?

What is your group at the beginning of the third dive?

96) You dive the following:

0830 Begin descent
0835 Arrive @ 63fsw
0917 Begin ascent
0919 Surface
1121 Begin descent
1123 Arrive @50fsw

1203 Begin ascent

1205 Surface

What was your bottom time on the first dive?

What is your group after the first dive?

If the second dive had been planned to a depth of 40fsw, what would have been your RNT?

What is your RNT following the first dive?

What is your group following the second dive?

After your second dive you find that the anchor is stuck and the fathometer is reading 50fsw. Strong afternoon winds are picking up and conditions are deteriorating rapidly (Sea State 4 going to 5). Your choices are to buoy off the anchor or dive to try to free the line. If you choose to dive, what is your surface interval? Explain your choice.

97) Each of you bring to the class your own unique experiences. Please prepare a question to present at the exam review session.

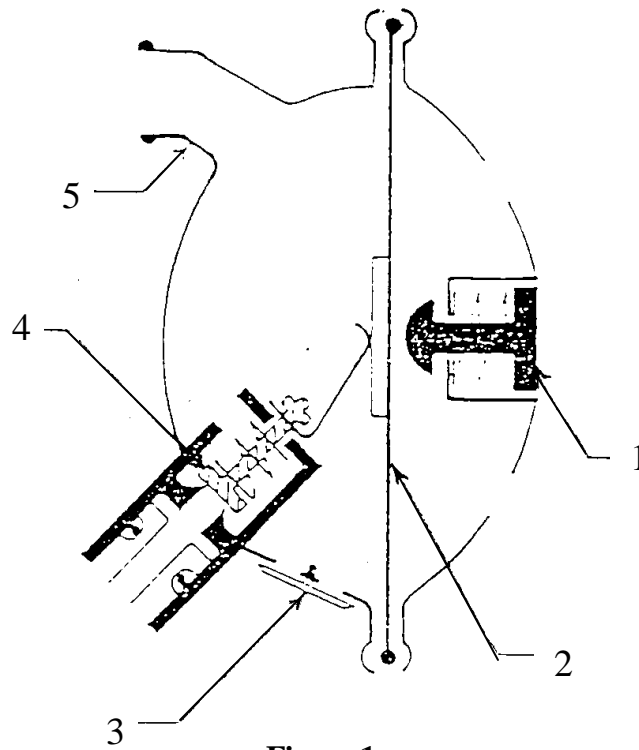


Figure 1

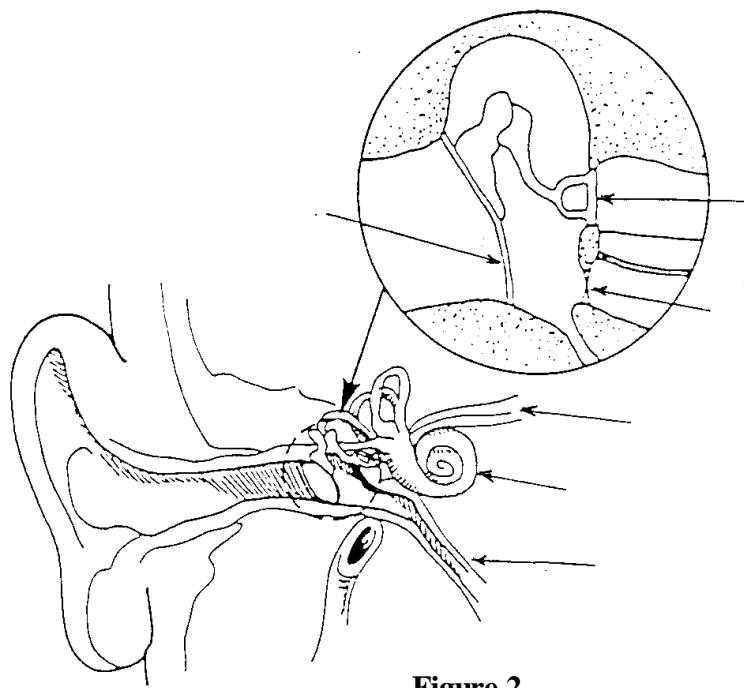


Figure 2